North Carolina Department of Health and Human Services
Division of Public Health
1908 Mail Service Center • Raleigh, North Carolina 27699-1908
Beverly Eaves Perdue, Governor Lanier M. Cansler, Secretary

Cancer Incidence Analysis for Guilford County

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Background

The Guilford County Health Department contacted the Occupational and Environmental Epidemiology Branch (OEE) and Central Cancer Registry (CCR) of North Carolina's Division of Public Health to investigate cancer incidence in the area surrounding the White Street and EH Glass landfills in eastern Greensboro, NC, 27405. This report focuses on liver cancer, pancreatic cancer, multiple myeloma, leukemia, brain and central nervous system (CNS) cancer, Hodgkin disease, and non-Hodgkin lymphoma in the area of concern and provides the methods and results of the investigation. The cancers chosen for this investigation are commonly studied when environmental factors are being considered, and were suggested by the Occupational and Environmental Epidemiology Branch of the Division of Public Health.

Methods

In order to be certain that all liver cancer, pancreatic cancer, multiple myeloma, leukemia, brain/CNS cancer, Hodgkin disease, and non-Hodgkin lymphoma cases were identified, the CCR used several sources of data. Reporting of cancer cases to the CCR is required of all health care providers. Most reports are received from hospitals, but physicians whose practices include cancer patients who are diagnosed and treated in their outpatient clinics also report cases. In addition, the CCR links its data with death certificate files to be sure that all cancers identified on death certificates are in the CCR database.

The CCR was established in 1986 and the first year of data collected was in 1987. At first these data came from 14 hospitals in the state and represented less than 50 percent of the cancer cases diagnosed in the state. Between 1987 and 1989, the CCR worked with hospitals across the state to establish reporting procedures and to train hospital staff in the collection of data. In 1990 the CCR became a statewide, population-based registry with all hospitals reporting cases. Since 1990, over 90 percent of the state's cases have been reported to the CCR, and in recent years, that percentage is over 98 percent. Most of the cases that are missed are those that are easily diagnosed and treated as outpatient cases, such as cases of skin and prostate cancer. The CCR has relatively complete data only since 1990. Hence this study is based on all cases of interest reported since 1990.

The set of parcels in eastern Greensboro that at one time belonged to the EH Glass company, and which are now an unregulated garbage dumpsite, and the White Street landfill are located so close together, that for methodological reasons it would be very difficult to delineate a study area of potential environmental impact including one and not the other. While the study area chosen does not include the White Street landfill parcels, the potential environmental impact areas of both the dumpsite and the landfill were taken into consideration when delineating the study area. Through contact with Guilford County Health Department staff, it was determined that much of the area surrounding the White Street landfill and EH Glass dumpsite in eastern

Greensboro had been converted from farmland to a residential area in 1955. Furthermore, the development of the residential property took place almost simultaneously with annexation of most of the area by the City of Greensboro, which meant that newcomers were soon using municipal water. Municipal water is supplied by lakes Townsend and Brandt, which are located far from the locations of the landfills, in a well protected watershed with no point source pollution. The number of persons who have been using well water in areas around the dumpsite and landfill, simultaneous with the operation of the both, has not been determined, but is expected to be very low relative to the study area population as a whole. Nevertheless, the study area was delineated to account for *potential* exposure to compounds through air or water. Ground and surface water in the area flow to Buffalo Creek and its tributaries, according to staff from the Guilford County Health Department, in a southwest to northeast direction.

This is also the predominant direction of ambient air flow for Guilford County, according to annually summarized windrose data created by the Division of Air Quality in North Carolina's Department of Environmental and Natural Resources (DENR) which used data from the Greensboro Airport wind monitoring station. No proximate air quality monitoring data were available for the EH Glass dumpsite. Previous air dispersion modeling reviewed by NC DENR Division of Air Quality staff at the White Street landfill indicated that no toxic air pollutants tested appeared in concentrations greater than North Carolina Acceptable Ambient Levels, as determined by the North Carolina Scientific Advisory Board[1]. No burning of garbage has taken place at the White Street landfill, and emitted gases are flared, according to staff at the City of Greensboro Environmental Services Department.

At the time this report was written, the City of Greensboro Environmental Services Department was in the process of testing monitoring wells to delineate an area of tree planting remediation around a well that had intermittently shown elevated levels of some hazardous compounds. The intermittent higher levels correspond to wetter periods in the spring, when compounds are diluted and appear at lower levels, and dryer periods during late summer when the compounds are less dilute and more concentrated. Because the remediation area delineation work was not finished, it was not used in the delineation of a study area for this report.

CCR staff cooperated with staff from the Division of Public Health's Occupational and Environmental Epidemiology Branch to delineate a study area, using the environmental data available at the time the report was written. The study area is comprised of Census 2000 block groups that are adjacent and near to the EH Glass landfill. These block groups were chosen because they best represent the area of potential air or water exposure to any compounds released from either the EH Glass dumpsite or White Street landfill (see Figure 1).

To evaluate whether there has been greater than expected cancer incidence in the area surrounding the site, we compared the number of cases in the study area with the expected number of cases in the same time period. The procedure used for calculating the expected number of cases for each block group was to apply the age and gender-specific cancer incidence rates for the state to the age and gender-specific populations of the census block groups. This gives an expected number of cases for each age and gender group. These were added to arrive at an expected number for the entire census block group; the sums for the census block groups were then added to obtain the overall expected number for the study area.

Geocoding Success

There were 4,250 cases of cancer of the aforementioned primary cancer sites for Guilford County in the period 1990-2006. Of these, 120 could not be geocoded to street level, as they had a Post Office Box or other address that prevented that level of precision. Of the remaining 4,130 cases, 4,103 (99.3%) were geocoded to street level. Of the geocoded cases, 114 were able to be located within the study area.

[1] Sellman, J. and Roller, J. (Division of Air Quality, North Carolina Department of Environment and Natural Resources) Internal Memorandum: "Dispersion Modeling Analysis Review – Greensboro White Street Landfill": 9/2/2005.

Results

Table 1 presents observed and expected incidence for males and females in the study area:

Observed and Expected Cases in Study Area, 1990-2006				
Type of Cancer	**Observed**	**Expected**	**Observed/ Expected**	**95% Confidence Interval[2] (Lower, Upper)**
Liver	*	*	*	*
Pancreas	27	14.90	1.81	(1.13 – 2.50)
Multiple Myeloma	13	6.39	2.03	(0.93 – 3.14)
Leukemia	17	13.85	1.23	(0.64 – 1.81)
Brain/CNS	22	16.15	1.36	(0.79 – 1.93)
Hodgkin Disease	*	*	*	*
NH - Lymphoma	27	25.98	1.04	(0.65 – 1.43)

NOTE: *Counts less than 5 and corresponding ratios are suppressed to protect confidentiality.*

In the study group that includes both males and females, the observed number of pancreatic cancer cases is 1.81 times higher than expected (see Table 1). The lower limit of the 95 percent confidence interval for the ratio of observed to expected cases is greater than 1.0, which indicates that the observed number of cases is significantly greater than the expected number of cases. The number of observed cases for each of the other primary cancer sites is not higher than expected. It must be emphasized that statistical significance does not imply causation, nor does a lack of statistical significance address the issue of biological relevance. Unidentified confounding variables could mediate the relationship. Further, there are potentially many causes of cancer that are not related to the physical environment. These include genetic factors, which may be a significant causal factor in many cancers including pancreatic cancer. Thus, a causal link between the observed elevated rates and exposure to the landfill cannot be established based on the findings of this investigation.

Limitations

The CCR has no residential, occupational, or medical histories about cases except as they may pertain to an earlier diagnosis of cancer. The CCR uses the county at the time of diagnosis as provided by the diagnosing facility to analyze cases by residence. It is recognized that this may not be the relevant address in terms of etiology for a disease with a long latent period that is causally related to environmental exposures, especially given the mobility of many populations. However, since we do not know at what point the disease process that was later diagnosed as a malignant tumor actually began, it is not possible to know the relevant address if etiology is considered. The focus of the CCR is on cancer surveillance, and hence, we use the address at diagnosis. This approach is consistent with procedures used by all other cancer registries in the United States including the National Cancer Institute's Surveillance Epidemiology and End Results (SEER) program, the North American Association of Central Cancer Registries, and the Centers for Disease Control and Prevention's National Program of Cancer Registries. Incidence rates for a chronic disease with a long latent period are useful for disease surveillance, but they may not be good indicators for investigating the etiology of a disease. The CCR also uses the date of diagnosis as provided by the reporting facility to determine in which year to classify each case.

[2] 95% confidence intervals were calculated for the rate ratios using the method described by Breslow and Day in: Breslow NE and Day NE. *Statistical Methods in Cancer Research, Volume II,* Lyon, France: International Agency for Research on Cancer, IARC Scientific Publications No. 32, 1987, p. 70-71.

Summary

The results of this investigation indicate that the number of pancreatic cancer cases observed among males and females in the study area is significantly greater than expected. However, it is important to reiterate that statistical significance does not imply causation. While the pancreatic cancer rates in the study area are elevated, the design of the study does not allow for conclusions about the link between the cancer rates in the study area and exposure to the landfill. Additional study would be needed before statements can be made about the connection between potential contaminants associated with the landfill and cancer rates in the study area. Thus, this study does indicate that there are elevated cancer rates in the study area, but does not indicate whether or not the elevated rates are associated with exposure to the landfill.

It should be noted that community cancer investigations are usually not a reliable means to determine etiology. Other than genetic factors discussed above, the only factors known to be associated with pancreatic cancer are tobacco smoking, chronic pancreatitis and diabetes mellitus. This, however, does not eliminate the need to address any known or discovered current environmental contamination.

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